ENVIRONMENTAL ASSESSMENT FOR PROPOSED RULE ENTITLED, "STORAGE OF SPENT NUCLEAR FUEL USING THE HOLTEC HI-STORM 100U VERTICAL VENTILATED MODULE SYSTEM AT NUCLEAR POWER REACTOR SITES"

DOCKET NO. 72-1014
HOLTEC INTERNATIONAL

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
Division of Waste Management and Environmental Protection

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FIGURES

ACRONYMS

ALARA:	As low as reasonably achievable
CFR:	Code of Federal Regulations
EA:	Environmental Assessment (prepared by the NRC)
ER:	Environmental Report (submitted by Holtec International)
FONSI:	Finding of No Significant Impact
GTCC:	Greater than Class C waste
HI-STORM 100U:	Holtec International's subsurface HI-STORM100U vertical ventilated module system for spent nuclear fuel storage
ISFSI:	Independent Spent Fuel Storage Installation
MPC:	multi-purpose canister
NCRP:	National Council on Radiation Protection and Measurements
NRC:	U.S. Nuclear Regulatory Commission
REMP:	Radiological and Environmental Monitoring Program
RFB:	refueling building
SAR:	Safety Analysis Report (submitted by Holtec International)
SER:	Safety Evaluation Report (prepared by the NRC)

1.0 INTRODUCTION

By letter dated April 27, 2007, as supplemented June 12 and July 14, 2008, January 16, 21, February 6, and April 6, 22, 2009, Holtec International (Holtec) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to amend Certificate of Compliance (CoC) No. 1014 for the HI-STORM 100 Dry Cask Storage System (License Amendment Request 1014-6, Revision 0). The amendment proposes to add an underground storage overpack that provides an alternative Vertical Ventilated Module (VVM) design to be used with the Holtec multi-purpose canisters (MPC) and the Hi-Trac transfer cask. This proposed design is the seventh in a series of HI-STORM 100 Dry Cask Storage Systems, for which specific safety and environmental reviews are required prior to the addition of a design to the list of approved spent fuel storage casks in 10 CFR 72.214. Under the requirements of 10 CFR 51.41, Holtec submitted an environmental report to NRC on June 2, 2008 as a reference document for evaluating the potential environmental impacts of this subsurface design. Holtec also provided supplemental information on December 19, 2008 in response to questions requesting additional information from the NRC staff.

A holder of an NRC license for a power reactor under 10 CFR Part 50 or 10 CFR 52 may construct and operate an independent spent fuel storage installation (ISFSI) at that power reactor site under the general license provisions of 10 CFR Part 72. Once CoC 1014, Amendment 7 system is approved for listing under 10 CFR 72.214, holders of NRC licenses under 10 CFR 50 and 10 CFR 52 will have the option of deploying the system at a general license ISFSI.

1.1 Background

The NRC licenses and regulates the interim storage of civilian spent nuclear fuel (SNF) in dry cask storage under 10 CFR 72. Interim dry storage of SNF by nuclear power plant operators is authorized by the Nuclear Waste Policy Act of 1982, as amended, until the issue of a disposition pathway (e.g., the siting, construction and operation of a permanent, deep geologic repository) is resolved and a plan implemented by the Federal Government. There are currently 55 licensed and operating ISFSIs at 51 sites around the United States. The footprint of most ISFSI storage pads at civilian nuclear reactors ranges from one-half acre to three acres in size, and requires additional land for buffer zones and security fencing; typically an additional one to two acres. Regarding the duration of interim storage, the Commission has determined that spent fuel can be stored safely and without significant environmental impact, in either wet storage or in wet storage followed by dry storage, for at least 100 years (55 FR 38511).

The environmental impacts of interim storage of civilian SNF at ISFSIs have been evaluated in several previous NRC environmental reviews. These include NUREG-0575, “Final Generic Environmental Impact Statement (FGEIS) on Handling and Storage of Light Water Power Reactor Fuel” (US NRC, 1979); NUREG-1092, “Environmental Assessment for 10 CFR 72 Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste” (US NRC, 1984); and an environmental assessment (EA) for the proposed rule entitled “Storage of Spent Nuclear Fuel in NRC-Approved Storage Casks and Nuclear Power Reactor Sites” (US NRC, 1989). The latter EA provided the basis for allowing deployment of ISFSIs under general licenses at nuclear power reactor sites without the need for additional site-specific approvals, but it did not consider subsurface designs. As such, this EA is being done to evaluate the potential impacts of construction, operation and decommissioning of subsurface cask arrays installed at a reactor site under the 10 CFR Part 72 general license.

1.2 Need for the Proposed Action

Holtec developed the subsurface HI-STORM 100U system to fill a potential market niche for nuclear power plant operators interested in utilizing a low-profile and more physically-hardened system for the interim storage of SNF. Utilities wishing to increase public confidence or address intervenor concerns regarding the security of interim on-site storage of SNF, would benefit from the availability of an underground system deployable under the general license provisions of 10 CFR Part 72.

1.3 Scope

The NRC staff is reviewing Holtec's request in accordance with the requirements under 10 CFR Part 72 for spent nuclear fuel cask storage systems and under the environmental protection regulations in 10 CFR Part 51. This document provides the results of the NRC staff's environmental review; the staff's technical and radiological review is documented separately in a Safety Evaluation Report.

The NRC staff has prepared this Environmental Assessment (EA) in accordance with NRC requirements in 10 CFR 51.21 and 51.30, and with the associated guidance in NRC report NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (NRC, 2003). The NRC regulation, 10 CFR 51.14, defines an EA as "a concise public document" that briefly provides "sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact."

1.4 Previous Environmental Assessments and Supporting Documents

Among the documents evaluated in the preparation of this EA were:

Draft Safety Evaluation Report of the Holtec International HI-STORM 100U Cask System. (USNRC, 2007) NRC ADAMS accession number: ML070250251

HI-STORM 100U Final Safety Analysis Report submittal "License Amendment Request #6 to HI-STORM CoC". (Holtec International, 2007) NRC ADAMS accession number ML071280377

Environmental Report on the HI-STORM 100U VVM in the HI-STORM 100 MPC based storage system" (Holtec International, 2008) NRC ADAMS accession number: ML081910244

Additional references may be found in Section 10.0 of this EA.

2.0 THE PROPOSED ACTION

The proposed action is the approval of the Holtec HI-STORM 100U underground spent fuel storage system design for use under the general license authorized by 10 CFR 72.210 and, adding the system to the "List of Approved Spent Fuel Storage Casks" in 10 CFR 72.214. If approved, this cask design will be the first system to provide the option of below-ground, interim dry storage for SNF that has been stored in reactor facility spent fuel pools for five or more years. The proposed casks would be deployed in an in-ground array. General licensees would be subject to the conditions of the general license set forth in 10 CFR 72.212, however, the use of an approved cask system under the general license requires no site-specific approval from the NRC.

2.1 Locations of the Proposed Action

The Holtec HI-STORM 100U cask system could potentially be deployed at any licensed commercial reactor site meeting the attendant site parameters listed in 10 CFR 72.212 (the regulation setting forth the conditions of the general license) and the CoC 1014 requirements for the cask system.

2.2 Description of Proposed Underground Dry Cask Storage System

The HI-STORM 100U is a subsurface dry cask storage system designed to accommodate all NRC-approved Holtec multi-purpose canisters (MPCs). MPCs are sealed stainless steel vessels that may contain spent light water reactor fuel and “greater than Class C” (GTCC) waste. The subsurface cask, referred to as the vertically ventilated module (VVM), consists of a below-grade cylindrical vertical storage cavity and closure lid (Figure 1), provides radiation shielding and structural protection of the MPC during storage (Figure 2). The fixed structure of the vertical storage cavity, identified by Holtec as the “Cavity Enclosure Container” (CEC), is made of a cylindrical container shell integrally welded to both a bottom plate and upper container flange. A continuous weld between the container shell and bottom plate is done to ensure that the CEC is completely sealed at its base. The constituent parts of the CEC are fabricated out of ~2.54 cm (~1 in.) thick low-carbon steel plate, and are coated with epoxy paint following fabrication. During mounting of the CEC on the below grade support foundation, the cylinder is equipped with zinc cathodic protection to further mitigate the effects of subsurface corrosion. For installation in highly corrosive soils, the subsurface outer shell of the VVM would be encased in concrete for additional protection against corrosion.

As installed in the subsurface, an individual VVM extends approximately 5.8 m (19 ft) below ground surface and rests in a recess in a concrete support foundation of requisite thickness (0.61 – 0.91m) (2 to 3 feet). Engineered backfill surrounds the VVM for most of its subsurface interface, but the VVM is encircled by a two-foot-thick reinforced concrete top surface pad at its uppermost portion (Figure 1). The VVM is capped by a massive steel and concrete ventilated closure lid that extends about a foot and a half into the CEC, thereby minimizing the lid’s height above ground surface to about 0.74 m (~ 29 in.), and preventing its horizontal shifting during design basis events. Internally, the CEC is equipped with a removable insulated divider shell and MPC bearing pads to help meet cask thermal performance requirements. The divider shell and closure lid are configured to allow outside ambient air to flow through the outer openings of the VVM, down the outer annulus of the CEC and into inner annulus surrounding the MPC. Circulation is driven as air heated by the MPC rises the through lower divider shell openings, up the inner annulus and out through the center of the closure lid. All ventilation openings in the VVM are covered with stainless steel wire mesh to preclude the entry of small birds and mammals. The stainless steel bearing pads at the base of the CEC create a bottom plenum underneath the MPC for additional access to coolant air and prevent direct contact between the MPC and the base of the cylinder. The CEC internals are also engineered to allow the easy placement and removal of MPCs; either for maintenance of the CEC or eventual offsite disposition of the MPCs.

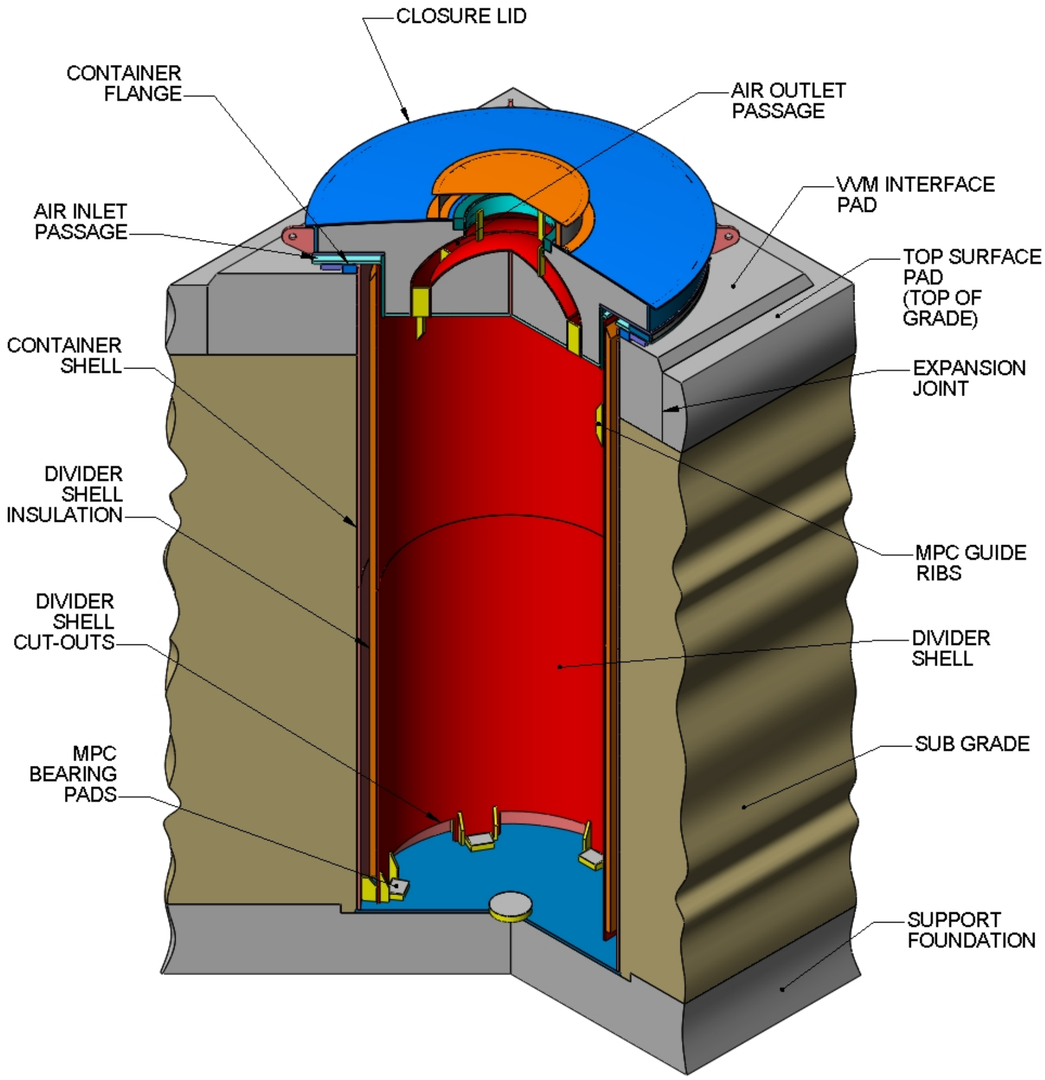

Figure 1: Cut-Away View of the HI-STORM 100U VVM (Holtec, 2008)

For deployment of multiple HI-STORM 100U VVMs at a general license ISFSI, the modules can be placed in a rectangular gridded array with a minimum pitch or spacing of 3.67 m (12 ft) (center to center). Twelve-foot spacing can be used to achieve a reduced footprint, if space considerations merit, while allowing bi-directional orthogonal access to each unit by all commercially available cask transporters. Figure 3 shows the layout of 5 x 5 canister array with 3.67 m (12 ft) spacing. A typically-sized array of 64 casks with such spacing would occupy less than 0.1 ha (0.25 ac), while more typical 4.89 m (16 ft) spacing would increase the area to just under 0.2 ha (0.5 ac).

Regarding the life-of-plant SNF storage needs, a potential 80-year operational life for a nuclear power reactor is considered to estimate the maximum footprints of vertical cask arrays at reactor sites. A review of reactors with long operating histories (NRC, 2005a; NRC 2009) shows that per 1000 MWe, approximately one MPC of SNF has been generated per year over a 35-year period. With increasingly higher fuel burnup rates allowed by NRC regulations, now up to 62,000 MWD/MTU from an earlier limit of 35,000 MWD/MTU, there has been a marked decrease in the generation of SNF per unit of power produced.

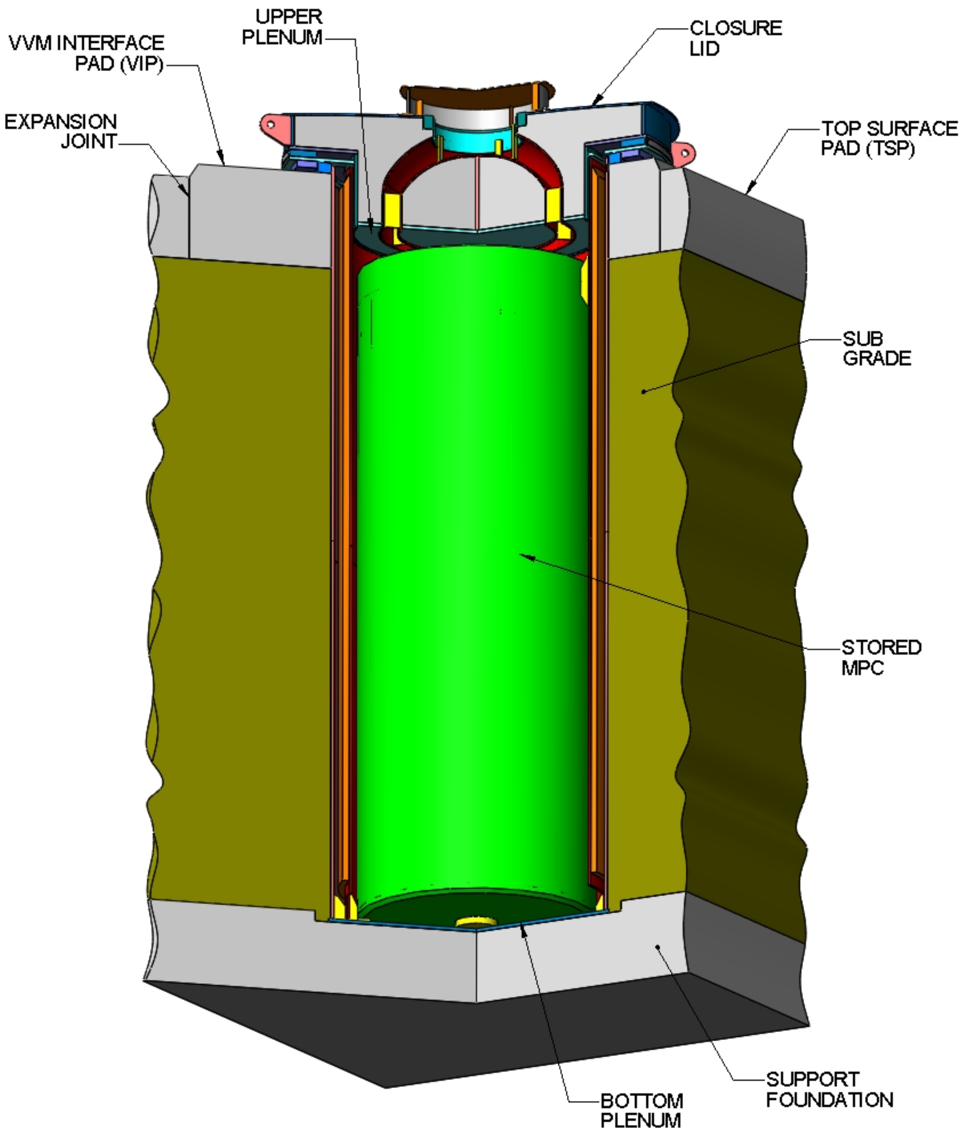

Figure 2: Cut-Away View of HI-STORM 100U VVM loaded with MPC (Holtec, 2008)

As such, the rate of SNF accumulation per MWe generated is expected to decrease compared to previous generation levels. Nonetheless, historical data is used for a conservative estimate of maximum SNF storage needs at reactor sites. For a multi-reactor site with 4000 MWe capacity, the total number of MPCs anticipated to be filled over an 80-year period is 320; requiring four 80-cask arrays or five 64-cask arrays. The total pad areas needed for the aforementioned multiple arrays (at 16 foot cask spacing) would be under two and a half acres, and just over two acres, respectively. Requisite ISFSI buffer zones, spoils storage areas and security fencing would involve an additional four to five acres of land, totaling a potential maximum land area of under seven and a half acres dedicated to a plant's ISFSI to meet individual reactor site life of plant SNF storage needs.

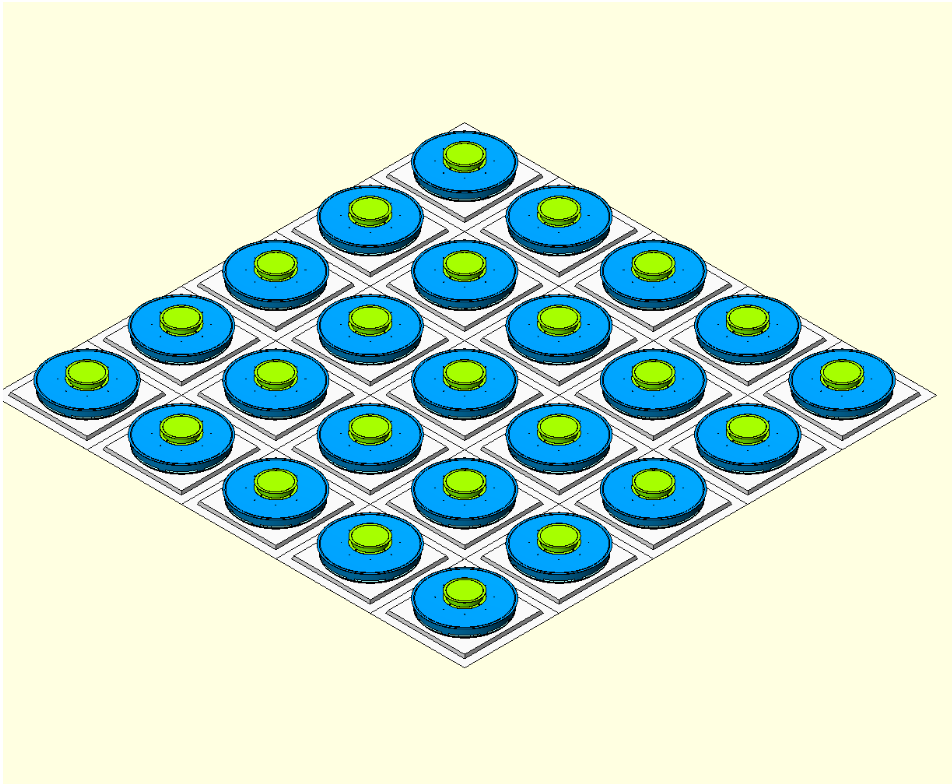

Figure 3: HI-STORM 100U VVM ISFSI Array for 25 casks (Holtec, 2008)

2.3 Planned Activities

The activities associated with deployment of a HI-STORM 100U cask system include the following three phases: site preparation, operation, and decommissioning. While life of plant SNF storage needs could require up to five 64-unit arrays, total storage capacity is not required initially and cost considerations drive reactor operators to favor incremental cask deployment. As such the phases of 64-unit cask deployment are described below. The effects of multiple arrays of 64-unit arrays are addressed under cumulative impacts in Section 5.4.

2.3.1 Site Preparation

The major site preparation elements of associated with deploying a HI-STORM 100U cask system would be (1) the installation of the subsurface vertical ventilated module array, (2) construction of an associated security building and installation of fencing (if not already existing), and (3) construction of a transport route from the reactor to the cask array. The site preparation of a 64 unit array is expected to take approximately six months to a year, with activity occurring generally during daylight hours. Activities would be confined to the area within the owner controlled area, with the construction limited to the vicinity of the array site and the nearby onsite excavation spoils storage area.

Construction of the vertical ventilated module array would require the removal of site vegetation, soil excavation, spoils disposal, forming and pouring the concrete slab support for the vertical ventilated module array, and excavation of appropriate backfill (if available on site). A 64 unit array would require a 6.72 m (22 ft) deep excavation of an area measuring approximately 45.8

m x 45.8 m (150 ft x 150 ft); a total of about 14,844 m^3 (18,000 yd^3). This material would be excavated using standard earthmoving and digging equipment and placed onsite in a spoils storage area. This material stockpiled to a height of 6.1 m (20 ft) with 3:1 slopes would occupy and area of about 76.4 m x 76.4 m (250 ft x 250 ft) or 0.57 ha (1.4 ac). Depending on the engineering properties of soils at a given site, some of it might be used as backfill during installation of the VVMs. Alternatively, it could be used for a surrounding berm or for final site contouring. Concrete for the foundation pad and surface support pad would be obtained from offsite sources. The finished in-ground VVM array, with dimensions of approximately 44 m x 44 m (144 ft x 144 ft) is designed to accommodate 64 storage casks.

At sites with a shallow water table, dewatering of the area to be excavated would be required to allow for construction and installation of the concrete support foundation, VVM cylinders and placement of engineered backfill. As sites with high water tables are usually located in areas with high levels of precipitation and recharge, groundwater would be expected to return to its previous levels within several months to a year following the cessation of dewatering activities.

A single-story security building is typically constructed at all ISFSI sites. The security buildings are approximately 6.1 m x 12.2 m (20 ft x 40 ft), no more than 6.1 m (20 ft) in height and are located outside the security fencing for the ISFSIs. Construction of the security building would involve minor excavation in order to install the footing and foundation for the building and accommodate for any water, sewer, electrical, and telephone connections. Construction materials, including concrete, lumber, glass, and insulation are typically brought in from offsite. Other auxiliary security components of the ISFSI include the installation of chain-link fencing, perimeter lighting, and security surveillance monitoring equipment. If the Holtec HI-STORM 100U cask system is being deployed at a pre-existing ISFSI site, construction of the security building and installation of the fencing and other fixtures may not be necessary.

A haul road between the reactor refueling building and the ISFSI would be required to accommodate the cask transporter and support vehicles. The size of haul roads documented in site specific ISFSIs (NRC, 1986, 1988, 2005b) are about 7.6 m to 8.0 m (25 to 30 feet) in width and between 61.1 m to 244.4 m (200 and 800 feet) long. Security considerations, transport costs and logistics are factors that result in most ISFSIs being sited a relatively short distance from the reactor refueling building in the owner-controlled area. If the Holtec HI-STORM 100U cask system is being deployed at a pre-existing ISFSI site, construction of the haul road may not be necessary.

2.3.2 Operation

Implementation of cask system deployment involves pre-operational testing, transfer of the SNF from the spent fuel pool to MPCs, placement of the MPCs in the HI-STORM 100U VVMs, and operational monitoring.

Before any fuel would be moved from spent fuel pools for placement in the HI-STORM 100U cask arrays, licensees would perform pre-operational and start-up testing of the relevant equipment. These pre-operational tests would be performed on the davit crane, the transporter, and all ancillary storage system components, such as the automated welding and drying systems. The startup testing plan would be used to verify the performance of the storage system and to ensure that plant equipment meets the functional requirements identified in the Holtec HI-STORM 100 Final Safety Analysis Report. Mock-ups and actual plant equipment would be used during start-up activities.

The spent fuel transfer process would be initiated with the lowering of a transfer cask, with an empty MPC inside, into the spent fuel pool. Spent fuel assemblies then would be loaded into the MPC and verification of the assembly identification provided. While still underwater, a thick MPC lid would be installed for shielding. When the transfer cask is removed from the spent fuel pool, the lift yoke, cask, and top of the MPC would be rinsed down. Once removed from the spent fuel pool, the top surfaces of the MPC lid and the upper flanges of the cask then would be decontaminated. Dose rates would be measured at the cask to ensure that it falls within expected values. The MPC lid would then be seal-welded and all liquid water removed from the MPC.

Following successful completion of a dryness test, the MPC would be backfilled to a pre-determined pressure of helium gas. The backfill ensures adequate heat transfer during storage, and provides an inert atmosphere for long-term fuel integrity. Cover plates then would be installed and seal-welded over the MPC vents and drain ports. To provide redundant closure of the MPC lid and cover plate confinement closure welds, the MPC closure rings are placed on the MPCs and seal-welded. The MPC lid and accessible areas of the top of the MPC shell would be tested and checked for removable contamination and the cask dose rates measured. The overpack top next would be installed and secured for transport to the VVM.

After the overpack top lid is installed, the loaded MPC system would be rigged to the onsite transporter and loaded into the VVM. Once in the VVM and capped with the closure lid, no active components are needed to ensure safe storage of the spent fuel, which cools through passive air circulation. No gaseous or liquid effluents are discharged during the storage period.

The above described processes are similar to those processes used for above-ground cask systems.

Requisite security surveillance, radiological monitoring and maintenance inspection activities are performed regularly as part of ISFSI operations for the duration of the NRC general license. These surveillance, monitoring and maintenance activities would be conducted by the licensee regardless of whether the ISFSI contains above-ground or subsurface cask systems.

2.3.3 Decommissioning

Upon expiration of the general license to store spent fuel in the Holtec HI-STORM 100U, per 10 CFR 72.212(a)(3), the MPCs containing the spent fuel elements would be removed from the HI-STORM 100U VVM. The removed spent fuel assemblies will then either be repackaged in another cask system, placed in another form of interim storage, or placed in permanent disposal (i.e., placed in a permanent, deep geologic repository), if available. This process would be the same for any of current above-ground cask systems.

As the general license for an ISFSI arises as a function of the underlying power reactor license (either 10 CFR Part 50 or Part 52), then the decommissioning of the ISFSI itself will be a part of the decommissioning for the power reactor facility. Alternatively, the licensee may convert the general license to a Part 72 site-specific license, in which case, any further storage of spent fuel in the Holtec HI-STORM 100U system would be the subject of a license condition and any ISFSI decommissioning would be conducted in accordance with 10 CFR 72.54. Both the decommissioning of the power reactor facility and the conversion of the general license to a site-specific license would constitute a separate action and thus, require a separate NEPA analysis at that time.

An ISFSI site decommissioning process would include:

- The timely identification and removal of any residual radioactive materials above the applicable NRC limits for unrestricted use.

- Performance of a final radiological survey release of the site for unrestricted use in accordance with 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination," and termination of the power reactor facility license or the Part 72 site-specific ISFSI license.

2.4 Duration of the Proposed Action

Upon NRC approval (by rulemaking that would add the Holtec HI-STORM 100U system to the list of approved cask systems in 10 CFR 72.214), holders of power reactor licenses would be able to use the HI-STORM 100U dry cask system under the general license authorized in 10 CFR 72.210, subject to the conditions of the general license set forth in 10 CFR 72.212. Use of an approved cask system under the general license requires no site-specific approval from NRC. The term of the general license is 20 years, commencing with the first use of that cask system by the general licensee, although the general license may be extended if the underlying CoC, upon which the general license is based, is renewed per 10 CFR 72.212(a)(3) and 72.240.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

3.1 No Action Alternative

Under the "no action" alternative, the subsurface HI-STORM 100U cask system design would not be approved by the NRC and thus, not made available for deployment under the general license authorized by 10 CFR 72.210. Cask system choices for general licensees would remain limited to those listed in 10 CFR 72.214 (currently, all above-ground cask systems). Applicants for and, holders of, Part 72 site-specific licenses would be able to request approval to deploy the HI-STORM 100U system. If approved, the deployment of the HI-STORM 100U cask system by a site-specific licensee would be made subject to the conditions specified in the license (the conditions of that license would only apply to that ISFSI, not generically). The NRC would be required to conduct a separate NEPA analysis for the issuance of a site-specific Part 72 license.

4.0 AFFECTED ENVIRONMENT

4.1 Licensed Commercial Nuclear Reactor Sites

The HI-STORM 100U could potentially be deployed as a cask system array at any licensed nuclear power reactor site in the United States. In order for a nuclear plant to enter into commercial operation under NRC license, it must first undergo extensive safety and environmental reviews. The environmental review process involves the development of an environmental impact statement, which is a detailed written statement as required by section 120(2)(C) of the 1969 National Environmental Policy Act (NEPA). The environmental impact statement provides an assessment of the potential impacts of reactor construction, operation and decommissioning on public health, safety and the environment. Plants built prior to NEPA have been subject to detailed environmental reviews during their license renewal process and tier off of NUREG-1437: Generic Environmental for License Renewal of Nuclear Plants (USNRC, 1996). Site-specific reviews for renewals of all plants are documented by supplemental environmental impact statements (SEISs).

Because the affected environment of each plant is site specific, a description of all the affected environments in this assessment would be too voluminous to be useful or informative. As such, the affected environments of each plant are incorporated by reference to the respective plant specific environmental documents (EISs, GEISs and SEISs) that have been prepared for each site. All of these NRC environmental review documents are available for public inspection and copying at NRC's Public Document Room, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. Additionally, many of these documents are available for public review through the NRC's electronic reading room, at: http://www.nrc.gov/reading-rm/adams.html. The aspects of the affected environment covered in these publications include land use, demography, climatology and meteorology, hydrology, geology and soils, ecology, transportation and historic, scenic and cultural resources.

4.2 Background and Reactor Site Radiological Characteristics

The typical average annual total effective dose equivalent to a person living anywhere in the United States from background sources of radiation is approximately 3 mSv (300 mrem) (NCRP, 1987). This dose comes from exposures to cosmic radiation, cosmogenic radionuclides, terrestrial radionuclides, inhaled radionuclides, and radionuclides naturally occurring in the body.

In comparison, the results from the above mentioned annual reports indicate that direct radiation from all nuclear plant sources are consistently well below 1 mSv (100 mrem) for all reactor sites (NRC, 2006). An Environmental Protection Agency (EPA) Report (520/7-79-006) showed that in 1979 that average doses to the public from pressurized water reactors to be around 2 mrem/yr, while boiling water reactors were on the order of 13 mrem/yr (EPA, 1979). With the implementation of ALARA principles for reactor activities, doses to the public from reactor sites have dropped further since. A more recent 2007 report by EPA (EPA-402-K-07-006) estimates that the doses to those living near a nuclear power stations now averages less than 1 mrem/yr.

5.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

5.1 Non-radiological Impacts

5.1.1 Site Preparation

The environmental impacts due to installation of the HI-STORM 100U system under a 10 CFR 72 general license are expected to be small. The system would be located within the boundaries of the controlled areas of 10 CFR 50 and 10 CFR 52 licensed nuclear reactor facilities; areas that have usually been previously disturbed during nuclear power plant construction and operation. Site preparation activities associated with individual subsurface arrays would impact less than 0.81 ha (2 ac) of land area. This impact would involve excavating the foundation footprint (approximately 0.2 ha [1/2 acre]) to an approximate depth of 6.72 m (22 ft), stockpiling the excavated soils, forming and pouring the concrete support pad for the CEC units, mounting the CEC units on the pad, burying the CEC units with engineered backfill, pouring a protective concrete surface pad, installing miscellaneous structures, and controlling site-preparation related dust and runoff. Most site preparation materials would be derived from offsite sources. Depending on the specific site, however, some of the excavated soils possessing the requisite properties for use as engineered backfill and could be reused.

Dust generated during site preparation activities is expected to be minimal, given that traffic for these activities would be using paved onsite and offsite roadways. Dust derived from excavation and fill operations can be mitigated through dust control techniques (e.g., watering and/or chemical stabilization). Routine truck washing and covering truck-hauled materials would contribute to minimizing dust emissions. Gaseous emissions from site preparation equipment are mitigated through regular maintenance of the equipment.

The spoils storage area would cover an area of approximately 76.4 m x 76.4 m (250 ft x 250 ft); about 0.57 ha (1.4 ac) and would likely be located within an area that had been disturbed previously by plant operations. This area would be accessed via a new or existing road, and the transport and deposition of the excavated material is not expected to have a significant environmental impact. Stockpiled material there would be spread and contoured to conform with existing topography. As appropriate, use of best management practices would address storm water runoff, erosion control, and revegetation. It is expected that all areas disturbed during site preparation activities would be revegetated with a locally appropriate seed mix.

The installation of ISFSIs at existing nuclear power reactors has typically required that 20 to 25 workers to establish the ISFSI, construct the security building, and put up security fencing (e.g. Humbolt Bay – NRC, 2005b). Most workers would be drawn from the local work force and therefore, would have minimal impact on the local demography and local resources, such as schools and hospitals.

The effects of noise and traffic on the area as a result of site preparation activities are estimated to be small. Traffic to and from the site would be by way of existing paved roads and highways. The noise level from site preparation activities would be similar to the noise levels from any similar project and would be limited to daylight hours. The nearest residents from an ISFSI site are not expected to be adversely affected by noise from site preparation activities due to set back distances. The site preparation workers would comply with the applicable OSHA noise regulations to minimize noise impacts.

The impact of site preparation activities on local water sources and wetlands is expected to be small. Discharges from individual NPPs are regulated under a discharge permit issued by the states. A licensee is required by applicable state laws to modify its discharge permit to account for additional clearing and grading of the site. Permits conditions stipulating the use of best management practices for erosion control and soil stabilization during ISFSI construction will protect local waters and nearby wetlands from site runoff, spillage, and leaks.

Because ISFSI site preparation activities have historically occurred in previously disturbed areas around nuclear power plants and the ISFSI footprint is only a few acres in size, future HI-STORM 100U deployment is not expected to adversely impact the habitat of any state or federally listed threatened or endangered plant, terrestrial wildlife, marine life, or fish species.

Site preparation activities could impact buried historic, cultural and archaeological resources not recognized during previous surveys of a given site. If any new historic, cultural and archaeological resources are discovered during project activities, industry practice dictates that work must stop and the state archaeologist be notified to evaluate and document the finding, and mitigate any potential impacts of continued site preparation activities.

Visual/scenic impacts would be minimized as the Holtec HI-STORM 100U system would be deployed as in-ground system, with the top of the cask closure lids being around 0.61 m (2 ft) above ground surface. The associated security building and the fencing (if not already pre-existing) would be of lower profile than other buildings, towers and structures on NPP sites, which have the greatest visual impact.

5.1.2 Operational Impacts

As discussed previously, operation of the HI-STORM 100U system would involve loading the spent fuel into the MPCs while in the reactor refueling buildings, moving the loaded casks from the building to the in-ground HI-STORM 100U VVMs, placing the casks in the VVM and then closing the ISFSI. Once the VVMs are capped with closure lids, the licensees would conduct long-term monitoring of the VVMs and surrounding area under their Radiological Environmental Monitoring Programs.

Operation of an in-ground HI-STORM 100U cask array would not require any additional land beyond that used for the cask array and security building. The fenced-in security area surrounding the ISFSI would not significantly affect the area available for terrestrial wildlife. In addition, ISFSI operation is not expected to adversely impact terrestrial and aquatic environments or their associated plant and animal species. Operation would not require water resources, but the lower part of VVMs could be in contact with groundwater at sites with a high water table. Because the VVMs are cooled by ambient air flowing down their outer annulus, and are epoxy-coated and seal-welded, the groundwater temperature and quality would not be affected by the presence of the VVMs. Conversely, the sealed construction design of the VVMs will prevent the ingress of groundwater into the cavity enclosure containing the MPC. Monitoring for water intrusion into the VVM is a requisite safety requirement to ensure that natural air circulation for MPC cooling is not impeded. Hence, in the event of the entry of groundwater, corrective action and repair of the VVM would be required to permit continued operation of the cask. Because MPCs are leak tested sealed stainless steel vessels, there would be additional protection against groundwater contamination if any short-term leaks occur.

Due to the passive nature of the HI-STORM 100U system, no gaseous or liquid effluents would be produced during operation. Finally, operation of the HI-STORM 100U system would not generate any significant noise and would not impact climate, historic, cultural or archaeological resources, transportation or socioeconomics.

5.2 Radiological Impacts

5.2.1 Normal Operations

Occupational Doses

During the site preparation phase, workers preparing the site would not be directly handling any radioactive material, thus any radiation dose is expected to be minimal and well below the limits set in 10 CFR Part 20.

Occupational doses may result from (1) loading the spent fuel into the multipurpose canister contained within the overpack while in the fuel handling building; (2) decontamination of the overpack and MPC in preparation for storage; (3) transport of the overpack from the reactor refueling building to the site of the in-ground VVMs; (4) transfer of the overpack and MPC from the transporter to the VVM; and (5) capping of the VVM. In addition, following VVM closure, occupational doses may result from security activities, inspections, and maintenance activities. All work would be done in accordance with a plant's radiation protection program and occupational doses must be maintained below the limits set in 10 CFR Part 20.1201.

Doses to the General Public

Normal ISFSI operations would not have a significant onsite or offsite radiological impact as there are no gaseous or liquid effluents associated with storage operations. Owing to the additional shielding provided by subsurface storage of the casks, doses would be well below the limits in 10 CFR Part 20.1301.

Radiological effects on wildlife are expected to be small. The proposed HI-STORM 100U system would be installed below grade and surrounded by security fencing. The ISFSI sites have a low habitat value due to significant development and use, hence are not attractive environments to threatened and endangered species. The fences would keep most species far enough from the array that the resulting radiation doses should pose no threat to wildlife, although some birds and small wildlife may intrude into the ISFSI area. To receive a significant dose, birds and small mammals would need to remain in almost constant contact with a storage cask and screens on the cask vents prevent the entry of such animals. The ISFSI area would not provide an environment attractive to wildlife, and monitoring activity around the area also would discourage wildlife from remaining in the area. Therefore, animals are not expected to receive significant radiation exposure as a result of the HI-STORM 100U system operation.

5.2.2 Accidents

The HI-STORM 100U system is designed for all applicable normal, off-normal, extreme events, extreme environmental phenomena and accident condition loadings pursuant to 10 CFR 72.124 and 72.236(c), (d) and (l). Dose rates as a result of these accident conditions do not exceed the limits in 10 CFR Part 72 and 10 CFR Part 20 as described in the Holtec's proposed FSAR [1.1] (Holtec, 2008).

The categories of loads on the HI-STORM 100U VVM are identified below. They parallel those for above-ground cask systems.

- Normal Condition: dead weight, handling of the Closure Lid, soil overburden pressure from subgrade, self-weight and from live load due to cask transporter movement, wind loads, snow loads, and buoyancy effect of water saturation of surrounding subgrade and foundation. Most normal condition loadings occur at an ambient temperature denoted as the "normal storage condition temperature"; however, for calculations involving the Closure Lid, a higher temperature is assumed when the VVM carries a loaded MPC since the Closure Lid outlet ducts will be subject to heated air.

- Off-Normal Condition: elevated ambient temperature, partial blockage of air inlets, and elevated wind speed.

- Extreme Environmental Phenomena and Accident Condition: handling accidents, fire, tornado, flood, earthquake, explosion, lightning, burial under debris, 100% blockage of air inlets, extreme environmental temperature, and 100% fuel rod rupture.

Based on Holtec's safety analysis report, none of the credible off-normal operations and hypothetical accidents described above would result in degradation in shielding or confinement capabilities of the HI-STORM 100U cask system. As such, there would not be any effect on occupational or offsite radiological consequences as a result of accident conditions or extreme environmental events.

The condition loadings are addressed in greater detail in Chapter 11 of the Holtec HI-STORM 100U FSAR. With respect to resistance to potential design basis seismic and tsunami hazards, a more detailed review is presented in the NRC staff's Safety Evaluation Report.

5.3 Impacts of Decommissioning

Decommissioning of the ISFSI would commence after the MPCs casks loaded with the spent fuel elements are removed from the VVM array and transported offsite. After the fuel is moved off site, the ISFSI decommissioning activities would be conducted in accordance with the NRC-approved ISFSI decommissioning plan.

Decommissioning activities would include surveying the area to determine the levels, if any, of residual radioactive material. Following removal of the MPC casks, the VVM array would be decontaminated, as necessary. The concrete surface pad around the VVM may be sectioned and removed, or alternately, left in place, as appropriate. After the storage array area has been decontaminated and/or removed from the site, the area may be covered with top soil, contoured, and replanted with native vegetation.

Small occupational exposures to workers could occur during decontamination activities, but these exposures would be much less than those associated with cask loading and transfer operations. Minor impacts from noise and dust could also result from dismantling the pad and structures, but they would be much less than similar site preparation impacts.

A final radiological survey would be conducted. If the results of the final survey indicate residual radioactive material, would not result in doses to members of the public below NRC's 25 mrem/year dose limit, then the site may be released for unrestricted use.

5.4 Cumulative Impacts

The NRC has evaluated whether cumulative environmental impacts could result from the incremental impact of the proposed action when added to the past, present, or reasonably foreseeable future actions. Owing to the relatively small footprint of ISFSI facilities, the impact of the deployment of multiple in-ground Holtec HI-STORM 100U arrays, when combined with previously evaluated effects associated with nuclear power reactor construction, operation and decommissioning, is not anticipated to result in any significant cumulative impacts. The offsite radiation exposure limits for an ISFSI specified in 10 CFR 72.104(a) explicitly include any contribution to offsite dose from other uranium fuel cycle facilities in the region. Therefore, the offsite dose contribution from the reactor sites has been included in the evaluation of radiological impacts from the deployment of the Holtec HI-STORM 100U cask system for an ISFSI.

6.0 MONITORING AND MITIGATION

In addition to the existing nuclear power plant radiological environmental monitoring programs, monitoring specifically associated with the cask array would be performed, including security checks, health physics monitoring and mitigation of any water intrusion. Thermoluminescent dosimeters would be placed along the ISFSI fence lines to monitor the radiation dose from the stored casks in an array. For each nuclear power plant site, annual monitoring program results are presented in two NRC publications entitled Annual Radiological Effluent and Environmental Reports for Operating Nuclear Power Reactors.

7.0 AGENCIES AND PERSONS CONSULTED

Because the proposed action is not associated with the siting of an in-ground Holtec HI-STORM 100U cask array at any specific nuclear facility, no other agencies or persons were consulted.

8.0 CONCLUSION

The NRC staff concludes that the site preparation, operation, and decommissioning of an in-ground Holtec HI-STORM 100U cask system array would not result in a significant impact to the environment. Site preparation impacts of the system's installation would be minor and limited to the ISFSI site and the excavated material disposal site. The ideal ISFSI sites are in owner-controlled areas that are located a short distance from the reactor buildings. Such sites normally have been previously disturbed during plant construction and operation. Similarly, the storage sites for the excavated material are expected to be located in adjacent previously-disturbed areas, which would not be significantly impacted. There would be minor impacts of increased noise and dust from equipment and activities during the site preparation phase, but this phase would be of short duration and would not impact off-site populations. The workers needed during the site preparation phase could be obtained from the local population without an adverse impact on the demographics of the area. As the Holtec HI-STORM 100U cask system array would be likely located in a previously disturbed site, within the plant's controlled area, any system installation is not expected to adversely impact cultural or historic resources, and any unexpected finds would mitigated by the cessation of digging and notification of the requisite state or tribal historic preservation officer. Owing to the small installation and operational footprint, NRC does not expect the deployment of the cask system to adversely impact the habitat of any state or federally listed threatened or endangered plant, terrestrial wildlife, marine life, or fish species.

There would be no significant radiological or non-radiological environmental impacts from routine operation of the ISFSI. The ISFSI is a passive facility and no liquid or gaseous effluents would be released from the storage casks. The dose rates from the spent fuel would be limited by the design of both the storage casks and the sub-surface VVM. The total occupational dose to workers at any given reactor site may increase slightly due to work associated with loading, transferring, and storing the casks, but all occupational doses must be maintained below the limits specified in 10 CFR Part 20 and must be kept as low as reasonably achievable (ALARA), in accordance with licensee's radiation protection programs. The annual dose to the nearest residents from general license ISFSI activities (which, to date have utilized above-ground cask systems) have always been significantly below the limits specified in 10 CFR 72.104 and 10 CFR 20.1301(a). It is expected that use of the Holtec HI-STORM 100U, with the increased shielding provided by an in-ground cask system, will result in the same, if not lower doses than the current above-ground systems. Thus, the cumulative dose to an individual offsite from all site activities is expected to be less than the limit specified in 10 CFR 20.1301. Occupational doses received by facility workers would not be expected to exceed the limits specified in 10 CFR 20.1201.

The impacts from decommissioning the ISFSI would be much less than the minor impacts of site preparation and operation. Small worker doses would occur during the removal of MPCs from the VVMs for transport offsite. Very small occupational exposures could occur during decontamination activities, if they are necessary, and minor noise and dust impacts could result from dismantling the VVMs and associated structures.

The environmental impacts of the proposed action have been reviewed in accordance with the requirements of 10 CFR Part 51. The NRC staff has determined that the storage of spent nuclear fuel in an in-ground Holtec HI-STORM 100U cask system array within the controlled area of a licensed reactor site would not significantly affect the quality of the human environment, either incrementally or cumulatively. Therefore, an environmental impact statement is not warranted for the proposed action, and pursuant to 10 CFR 51.32, a Finding of No Significant Impact (FONSI) is appropriate.

The documents related to this proposed action are available for public inspection and copying at NRC's Public Document Room, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. Additionally, these documents are available for public review through the NRC's electronic reading room, at: http://www.nrc.gov/reading-rm/adams.html (ADAMS accession numbers are listed after each reference).

9.0 LIST OF PREPARERS

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